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PATENT SPECIFICATION



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COMPLETE SPECIFICATION

Process for Improving Solid Carbonaceous Fuels

I, JEAN BENJAMIN TOUSTOU, a Citizen of the Republic of France, of 15, Place du Capitole, Toulouse (Hte. Garonne), France, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to the improvement of solid carbonaceous fuels and more particularly to facilitating the combustion thereof, and provides to this end combustion catalysts for the combustion of all solid fuels either natural or synthetic, such as for example, coal, coke, semi-coke, lignite, briquettes and the like, together with a process for the production of such catalysts.

The invention also relates to fuels consisting of a mixture in any suitable proportion of the aforesaid natural or synthetic solid fuels with said catalysts, said mixture having either been produced in a dry state at ordinary or elevated temperature, or by dissolving or suspending said catalysts in water, or in any other solvent, treating the fuel with said solution or suspension, and then submitting the treated fuel to further treatment, such as for example, distillation at high or low temperature.

The combustion catalysts of the present invention improve to a substantial degree all the factors which contribute to a better thermal efficiency; a higher proportion of carbon dioxide in the combustion gases, a substantial reduction in the quantity of air being introduced into the hearth, a very low proportion of unburnt substance in the clinkers, and finally, almost complete elimination of smoke.

According to the present invention, the fuel is treated with a small proportion of a catalyst in the form of a dry powder or as a solution or suspension obtained by the reaction either of solutions or suspensions of metallic salts containing boron, chromium, iron, and manganese, and of alkali metal or alkaline earth bases, or their corresponding salts, in water, and evaporating the reaction product down to dryness and if necessary, taking up the product again in a solvent or dispersing

medium such as water.

The metallic salts used in accordance with the present invention form various oxides which act as catalysts relatively to the carbon for combining with the oxygen of the atmosphere.

The alkaline salts, preferably the salts of sodium and potassium, act as promoting agents.

One of the features of the invention consists in the use, as anions, of acids furnishing stable compounds and non-corrosive gases at the temperature of the grate.

In accordance with the invention, use is made of sulphates and persulphates, carbonates and bicarbonates, chromates and dichromates, borates and perborates, manganates and permanganates and also oxidised compounds of phosphorus.

It has been found that an appreciable improvement of the action of the catalysts is obtained by mixing two or more of the aforementioned metallic salts, thus giving rise to an intimate mixture of metallic oxides which have the particular action of eliminating smoke.

It has also been ascertained that the evaporation of the solution and the subsequent drying of the products need not be carried out at a very high temperature to enable the metals to be obtained in the form of oxides.

Moreover an improvement of the action of the catalysts is obtained due to the circumstance that the oxides are formed on contact with the carbonaceous fuel.

These catalysts produce an excellent effect on the combustion of the carbon, on the condition, nevertheless, that the melting point of the ashes be sufficiently high.

It has been discovered that in certain cases the catalysts lose a part of their efficiency due to the fusibility of the ashes, such fusibility arising either from the nature of the fuel or from the elements entering into the composition of the catalysts.

Now, in accordance with the present invention, it has been found that it is possible to obtain further products of great catalytic capacity, while avoiding

the aforesaid drawbacks due to the fusibility of the ashes. The present invention also avoids lowering the melting point, which was due to the use of certain elements acting as flux in respect of the ashes and in consequence involving the agglutination of the fuel. A very appreciable increase has in fact, been produced in the infusibility of the ashes, which favours in the highest degree the desired catalytic action, by the use of compounds which make the ashes more refractory while enabling the products to retain their catalytic efficiency in the combustion of the carbon. The catalysts, moreover, act all the better in that their composition is adjusted depending on the chemical composition of the ashes so as to reduce the fusibility of the latter.

As has been stated above, use is made of anions which give, at the temperature of the grate, stable compounds or non-corrosive gases, to which are added, in place of alkali metal salts, compounds of aluminium, calcium, magnesium, barium, strontium, either alone or mixed in variable proportion, and acting as promoters for the metallic oxides and, in addition, modifying the chemical composition of the ashes in such a manner as to raise their melting point.

It has already been proposed to treat coal and other fuel with a solution containing a product obtained from specific quantities of *inter alia*, alkali metal salts, alkaline earths and boric acid, a dichromate and manganese dioxide, in order to increase the efficiency of said fuel. According to another proposal, the fuel is treated with a product obtained from a mixture of specific proportions of alkali metal salts, iron chloride, ferric oxide, calcium sulphate and tinctorial earths and extracts and water, by macerating and evaporating the water in a boiler, and mixing the resulting powder with water.

Purely by way of examples, there are given in the following two possible compositions of catalysts made in accordance with the invention, the first being suitable for fuels having an ash of high melting point, and the second being intended for fuels having an ash of relatively low melting point.

EXAMPLE I.

In 50 litres of water brought to boiling point or to a temperature close thereto there are dissolved in succession:

- 18 kgs. of potassium sulphate
- 10 kgs. of sodium sulphate
- 10 kgs. of boric acid
- 12 kgs. of sodium dichromate
- 2 kgs. of sodium carbonate
- 12 kgs. of iron sulphate

12 kgs. of magnesium sulphate
12½ kgs. of manganese sulphate.

Gentle heating is continued; the froth formed gradually disappears with stirring; on evaporation the solution gives a light yellow precipitate; it is evaporated to dryness, stirring the while in order to avoid over-heating.

When of a very syrupy consistency, the product is allowed to cool and the product dried in a drying stove at a temperature between 100° and 150° C. is ready for use.

This product is mixed in the proportion of 600 grams per ton of fuel, after having formed a solution or suspension of it in water. The product thus prepared is particularly suitable for bituminous or briquetted fuels.

The product may also be mixed in the dry state at an elevated temperature with the binder to be used in the manufacture of fuel briquettes, without losing its properties and without any risk of explosion.

EXAMPLE II.

In 50 litres of water brought to boiling point or a temperature near to 100° C. there are mixed in succession:

- 10 kgs. of iron carbonate
- 15 kgs. of ammonium dichromate
- 1.5 kgs. of magnesium carbonate
- 1.5 kgs. of aluminium sulphate
- 2.5 kgs. of manganese sulphate
- 10 kgs. of boric acid.

The solution is then treated in the manner described in Example I.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A process for improving natural or synthetic solid fuels, in which the fuel is treated with a small proportion of a catalyst in the form of a dry powder or as a solution or suspension obtained by the reaction either of solutions or suspensions of metallic salts containing boron, chromium, iron and manganese, and of alkali metal or alkaline earth bases, or their corresponding salts, in water, and evaporating the product to dryness and if necessary, taking up the product again in a solvent or dispersing medium, such as water.

2. Process as claimed in claim 1, in which the cations of the products taking part in the reaction are, on the one hand, boron, chromium, iron and manganese, and on the other hand, sodium, potassium, or magnesium, aluminium, barium, calcium, strontium, whilst the anions are the following radicles: sulphate, persulphate, carbonate, bicarbonate, chromate, dichromate, borate, perborate, man-

ganate, permanganate.

3. A process as claimed in any preceding claim, in which, the products improving the combustion of the solid
5 natural or synthetic fuels are added to said fuels before further treatment thereof for the purpose of converting them into briquettes, or into coke or semi-coke.

4. The process for improving solid carbonaceous fuels, substantially as 10 described.

Dated this 17th day of February, 1937.

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